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Emissions from a Pick-up Truck Retrofitted with a Nissan Diesel Engine

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16. ABSTRACT

S&S Equipment Sales, Inc., of West Chicago, Illinois deals in the retrofitting of pick-up trucks with Chrysler-Nissan 6N633 swirl chamber diesel engines. This type of vehicle was of interest to the EPA's Emission Control Technology Division (ECTD) as it relates both to ECTD programs in the areas of exhaust emissions from medium duty vehicles and exhaust emissions from small diesel engines which may be applicable to passenger cars. ECTD contacted the President of S&S and asked if he was interested in having EPA test one of his vehicles. It was agreed and the vehicle tested was a 1973 Ford F-250 pick-up truck with 4-speed manual transmission, retrofitted with a Chrysler-Nissan 6N633 swirl chamber diesel engine. The engine has 6 cylinders with 198 CID. At the time of testing over 10,000 miles had been accumulated on the vehicle.

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Emission Control Technology Division
Office of Air & Water Programs
Environmental Protection Agency

Background

An article appeared in a recent issue of Diesel & Gas Turbine Progress discussing the retrofitting of pick-up trucks with Chrysler-Nissan CN633 swirl chamber Diesel engines, being offered by S&S Equipment Sales, Inc. of West Chicago, Illinois. This type of vehicle was of interest to ECTD as it relates both to ECTD programs in the areas of exhaust emissions from medium duty vehicles and exhaust emissions from small Diesel engines which may be applicable to passenger cars. ECTD contacted Mr. John Carini, President of S&S, and asked if he had any interest in having one of his retrofitted vehicles emission tested by EPA.

Mr. Carini was interested in having a vehicle tested since many of his customers had asked him about the emission characteristics of the engine.

Vehicle Tested

The vehicle tested was a 1973 Ford F-250 pick-up truck with 4-speed manual transmission, retrofitted with a Chrysler-Nissan CN633 swirl chamber Diesel engine. The engine has 6 cylinders with 198 CID. At the time of testing slightly over 10,000 miles had been accumulated on the vehicle.

Test Program

It was decided to test the vehicle three times according to the 1975 Federal Test Procedure described in the November 15, 1972, Federal Register, except that the evaporative emission portion of the test was not included. The second and third tests were performed with the driver shifting at higher rpm levels than the driving trace calls for. This was done at the request of Mr. Carini because the engine was not putting out near maximum power at the lower shift points. For the three tests these engine rpms were used for shifting points:

Test 1: normal driver's trace, approximately 2000 rpm

Test 2: shifting at 3000 rpm

Test 3: shifting at 3500 rpm

The vehicle was tested at 4500 lbs. inertia weight.

Test Results

The test results are presented below. In addition to emission results, fuel economy was calculated using a carbon balance technique (all emission numbers in gm/mi).

Test	HC	CO	CO_2	NOx	MPG
16-481	1.40	3.70	442.5	1.70	22.2
16-485	1.83	3.88	467.4	1.67	21.3
16-491	1.88	3.84	473.5	1.88	20.7
AVERAGE	1.70	3.81	461.0	1.71	21.4

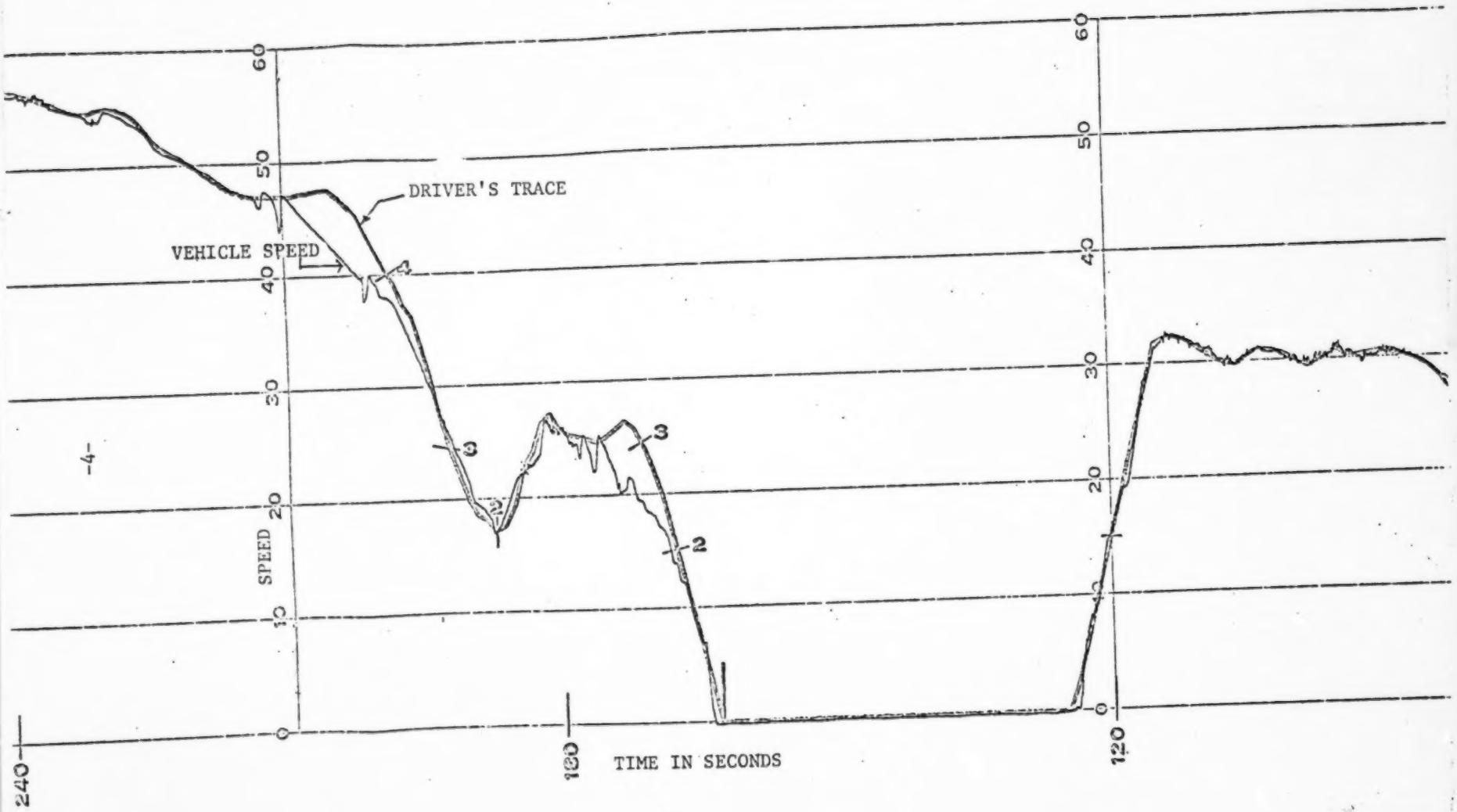
Emissions from a 1973 Ford F-100 pick-up with 360 CID engine and manual transmission were:

HC	CO	CO_2	NOx	MPG
2.2	26	---	2.0	9.9

Shifting at higher engine speed produced greater emissions than the standard shift points. When the driver was shifting at 3500 rpm, the vehicle was still not quite able to keep up with the driving trace (see attached).

Conclusions

Compared to a 1973 Ford F-100 pick-up with a 360 CID engine and manual transmission, the retrofitted vehicle has slightly lower HC and NOx emissions and about 85% lower CO emissions. Fuel economy for the Diesel pick-up was more than twice that of the gasoline engine version. Performance with the Diesel engine was not sufficient to keep up with the LA-4 cycle during the first two accelerations.



FEDERAL DRIVING SCHEDULE VOLUME 36 NUMBER 55 MARCH 20, 1971
(Driving Trace from Test 16-491, Shifting at 3500 RPM Engine Speed)